THE SUSCEPTIBILITY OF AN ADULT DAMSELFLY, *ISCHNURA VERTICALIS*, TO SELECTED INSECTICIDES[1]

J. F. ESTENIK AND P. F. FEDERLE[2]

Department of Zoology, The Ohio State University, Columbus 43210 and Department of Entomology, The Ohio State University, Columbus 43210

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Adult *Ischnura verticalis* females were given topical applications of selected insecticides (fenthion, malathion, propoxur and allethrin). Mortality was recorded after 12 hours. On a weight basis, adult *Ischnura* approximate the susceptibility of adult mosquitoes for these insecticides.

Chemical insecticides used to control aquatic insect pests are dispensed by various means, sometimes aerially. Numerous publications contain toxicity data for pest species that inhabit water during immature and/or mature stages (LC_{50} in water), or provide contact toxicity data for aerial adults with insecticides on various surfaces (LC_{50}). However, experiments that provide LD_{50} data (μg/insect) for aerial adults have been generally limited to mosquitoes. We have conducted some of the latter experiments with adult *Ischnura verticalis*, an aerial, non-pest damselfly species, using organophosphate, carbamate and pyrethroid insecticides that are presently recommended for aquatic insect control. Such toxicity data for the reproductive stage of a non-target aquatic insect may be helpful in assessing more completely the ecological impact of pest control measures in aquatic environments.

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MATERIALS AND METHODS

Adult insects were collected at Battelle Lake, West Jefferson, Ohio on the day of each experiment. The insects were transported from the collection site in 1 ft^3 screened, metal cages, and were treated immediately upon return to the laboratory.

The insecticides, at least 90% pure, were prepared as acetone solutions: fenthion, 0,0-dimethyl 0-[4-(methylthio)-m-tolyl] phosphorothioate; malathion, diethyl mercaptosuccinate, S-ester with 0,0-dimethyl phosphorodithioate; propoxur, o-isopropoxyphenyl methylcarbamate; allethrin, 2,2-dimethyl-3-(2-methylpropenyl) cyclopropanecarboxylic acid ester with 2-allyl-4-hydroxy-3-methyl-2-cyclopenten-1-one. New insecticide solutions were prepared for each experiment.

Insects were dosed without anesthesia by placing 1 μl of solution upon the mesonotum with an electric microapplicator (Isco.). Circular, plastic holding dishes, 6" x 1¼", were divided into three compartments with paper inserts and fitted with screen lids. Treated

insects were held, one per compartment, at 25±1°C. Each experiment was comprised of at least 3–5 different doses; the number of insects/dose varied between 9 and 24.

Mortality was recorded after 12 hours, corrected for control mortality (Abbott 1925), then plotted on logarithmic-normal graph paper. The best line was fitted by eye to pooled data of replicate experiments and the regression coefficients and LD_{50} values were determined by inspection.

RESULTS AND DISCUSSION

All LD_{50} values were within a fairly close interval of 1.0 to 4.6 μg/g. Except for allethrin, the regression coefficients (slopes) were generally low (table 1).

TABLE 1

LD_{50} values for insecticides applied topically to adult, homeochromatic Ischnura verticalis *females.*

Insecticide	12 hr LD_{50}, μg/g	Regression coefficient
fenthion (2)*	1.3	2.4
malathion (2)	1.7	1.4
propoxur (3)	1.0	3.1
allethrin (3)	4.6	4.5

*Number of experiments.

Preliminary experiments with both sexes revealed high mortality in the acetone controls after 24 hours. Female mortality in untreated checks and acetone checks was consistently reduced to 7–12% by shortening the observation period to 18 or 12 hours. The shortest time period was adopted as standard on the basis of these data.

The adult stage of damselflies lasts 1 to 4 weeks, depending upon species, sex, mating activity and environmental conditions (Corbet 1962). It appears that adults of this species, especially males, are very sensitive to collection, handling and experimentation. Moreover, insects in this order are aggressive, voracious predators. Treated insects had to be confined separately for observation to avoid death by predation. Otherwise, control mortality exceeded 50%.

Females of the genus *Ischnura* are dimorphic, the heterochromatic females with orange markings being more common than the homeochromatic females with light green markings (Usinger 1968). The average weights of males and both types of females, calculated from 34 individual weights in each group were (mg±S.D.): homeochromatic females, 19.2±2.1; heterochromatic females, 13.1 ±1.9; males, 15.1±1.6. The heavier homeochromatic females predominated in our population. In general, heavier insects of the same species will tolerate larger doses of insecticides. Thus, these toxicity data represent the response of the most tolerant form of this species.

Topical application data for other adult aquatic insects are scarce, but a few values were located for comparison with *Ischnura* (LD_{50} values in μg/g): *Culex pipiens quinquefasciatus*, fenthion (1.1) (Georghiou and Metcalf 1961); *Anopheles quadrimaculatus* (avg wt, 2.3 mg/insect) (Jeffery 1956), allethrin (3.5), malathion (4.2) (Ludvik 1953); *Aedes aegypti* (avg wt, 2.0 mg/insect) (Fisk 1950), fenthion (2.1), malathion (4.0), propoxur (3.7) (World Health Organization 1968). Adult *Ischnura* are apparently as susceptible to insecticides as adult mosquitoes on a weight basis, although the LD_{50} values of *Ischnura* in μg/insect are higher due to weight differences.

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REFERENCES CITED

Abbott, W. S. 1925. A method of computing the effectiveness of an insecticide. J. Econ. Entomol. 18: 265–7.

Corbet, P. S. 1962. A Biology of Dragonflies. Quadrangle Books, Inc. Chicago.

Fisk, F. W. 1950. Studies on proteolytic digestion in adult *Aedes aegypti* mosquitoes. Ann. Entomol. Soc. Am. 43: 555–57.

Georghiou, G. P., and R. L. Metcalf. 1961. A bioassay method and results of laboratory evaluation of insecticides against adult mosquitoes. Mosq. News 24: 328–37.

Jeffery, G. M. 1956. Blood meal volume in *Anopheles quadrimaculatus, A. albimanus* and *Aedes aegypti*. Exp. Parasit. 5: 371–5.

Ludvik, G. F. 1953. Topical application of insecticide solutions to *Anopheles quadrimaculatus*. J. Econ. Entomol. 46: 364–5.

Usinger, R. L. 1968. Aquatic Insects of California. U. of Calif. Press, Berkeley.

World Health Organization. 1968. Evaluation of insecticides for vector control. WHO/VBC/68. 66: 124–28.